PROCESS FOR DISTRIBUTION OF A PROGRAM CODE TO A PLURALITY OF MEASURING INSTRUMENTS

BACKGROUND OF THE INVENTION

[0001] This application claims a foreign priority from German patent application 100 50 546.5, and the contents of this priority application are incorporated herein by reference.

[0002] The invention concerns a process for distribution of a program code to a plurality of measuring instruments.

[0003] Measuring instruments, for example a network analysator network analyzer), a spectrum analyzer or a signal generator, are normally run on a control computer and are coupled to the control computer via a local bus system, for example an IEC-bus, a LAN-bus or a serial interface. There is a measuring routine on the control computer that controls the measuring sequence of operation and transmits individual measuring instructions to the measuring instruments and calls up the measured data from the measuring instruments. Various measuring functions are stored in the measuring instruments themselves as firmware, which can be periodically updated by the measuring-device manufacturer to make available to the customer, for example, new measuring functions, new error-correction functions or the like, or to switch to the customer new options of the measuring instrument.

[0004] A customer of a measuring-device manufacturer often has a plurality of control computers and a plurality of measuring instruments coupled thereto. When updating the firmware (software or data of the manufacturer) it has been necessary until now for the manufacturer of the measuring instruments to send to the customer a storage medium in the form of a CD-ROM, for example, and for the customer to insert this storage medium in each of its measuring instruments and to transmit the

program code of the new firmware to a local storage medium of the measuring instrument. Alternatively, it has also been possible for the measuring-device manufacturer to ship to every customer as many storage mediums, that is, for example, as many CD-ROMs as there are operating measuring instruments. This procedure has been relatively inconvenient and demands that the measuring instruments each be provided with a storage-medium reading device. Sometimes, the measuring instruments of a customer are also in a measuring environment that leads to a quick contamination of the storage-medium reading device so that a storage medium reading device on the measuring instrument can not be durably operated, rather it must be installed just for transmitting the new firmware.

[0005] It is an object of this invention to provide a method for distributing a program code to a plurality of measuring instruments that is particularly uncomplicated and cost effective and that does not require a storage-medium reading device on a measuring instrument.

SUMMARY OF THE INVENTION

[0006] According to principles of this invention, a method for distributing a program code to a plurality of measuring instruments that are respectively coupled with a control computer via a respective first bus, with the control computer being coupled with a central computer via a second bus, the central computer being coupled with one of a storage-medium reading device and an inter-regional network, includes the method steps of: feeding the program code to the central computer by one of placing a storage medium on which the program code is stored in the storage-medium reading device or by transferring the program code to the central computer via the inter-regional network; transmitting the program code from the central computer via the second bus to at least one control computer; and transmitting the program code from each control computer that received the program code, via the first bus, to the coupled

measuring instruments. Further enhancement are also described and claimed herein.

[0007] The invention is based on a recognition that instead of furnishing the measuring instruments with storage mediums having a new program code of the firmware loaded thereon in a decentralized manner, it is more rational to supply these storage mediums only to a central computer of a respective customer. The program code of the firmware is then transmitted over an internal intranet of the customer to the control computers of the individual measuring structures that, in turn, are connected to the measuring instruments by a measuring bus. For each customer of the measuring-device manufacturer it is therefore only necessary to load the storage medium, for example a CD-ROM, one time in his central computer, with the firmware to be brought up-to-date then being automatically transmitted to all measuring instruments in this installation. Alternatively, it is also possible for a measuring-device manufacturer to transmit the program code for updating firmware via the internet to the central computer of each of its customers with transmission of the program code then taking place over the customers' internal intranet to the control computers and from there via a measuring bus to the individual measuring instruments.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The invention is described and explained in more detail with reference to the drawing. The described and drawn features can be used individually or in preferred combinations in other embodiments of the invention. The foregoing and other objects, features and advantages of the invention will be apparent from the following more particular description of the invention, as illustrated in the drawing in which reference characters refer to the same parts throughout. The drawing is not necessarily to scale, emphasis instead being placed upon illustrating principles of the invention in a clear manner.

[0009] The only FIGURE of the drawing is a block diagram of an embodiment of the method of this invention.

DETAILED DESCRIPTION OF THE INVENTION

[0010] The drawing FIGURE shows a typical intra-networking structure of a customer of a measuring-device manufacturer. A central computer 1 is coupled via a second bus 19, for example a customer internal intranet or a LAN-bus, with a plurality of control computers 2, 3 and 4. The control computers 2, 3 and 4 respectively control different measuring systems 21, 22 and 23, with a control routine suitable for a measuring task stored in the control computers 2-4. The control computers 2, 3 and 4 are coupled with a plurality of measuring instruments 5-10 via a first bus 20, for example an IEC-bus or a LAN-bus or a serial interface, for example an RS232-interface. In the shown embodiment the first control computer 2 is coupled with the second measuring instruments 5 and 6, with the measuring instrument 5 being, for example, a network analysator and the measuring instrument 6 being, for example, a spectrum analyzer. In the shown embodiment the control computer 3 is only coupled with one measuring instrument 7, for example, a network analysator. Contrary to this, the control computer 4 is coupled with measuring instruments 8, 9 and 10, for example, two network analysators 8 and 10 and one spectrum analyzer 9. The control computers 2, 3 and 4 are positioned close to the therewith-associated measuring instruments 5, 6 and 7 and 8-10, while the central computer 1 can be located a large spatial distance from the control computers 2-4. The measuring instruments 5-10 are each coupled to a local memory 11-16, with, in the embodiment shown, the local memories 11, 12, 14, 15 and 16 being hard drives, or fixed discs, while the local memory 13 is an EEPROM. The program code of the firmware of the associated measuring instrument 5-10, which contains the functionality of the measuring instrument and, for example, the

instruction set, measuring procedures or error correction procedures is stored in the respective local memory 11-16.

[0011] According to a first variant of the method of this invention, in order to update the program code of the firmware in the local memories 11-16 an appropriate storage medium 18, for example a CD ROM is placed in a corresponding storage-medium reading device 17, for example a CD-ROM-drive. This storage medium 18 is sent to the appropriate customer in a normal shipping. The respective program codes for updating the firmware of the measuring instruments 5-10 is then transmitted via the second bus 19, in this embodiment the customer's internal intranet, to the control computers 2-4. The next time the respective measuring system associated with the particular control computer 2, 3 or 4 is placed in operation, each control computer 2, 3 or 4 transmits the respective program code to the measuring instruments 5, 6 or 7 or 8-10 that are coupled to it.

[0012] The program code is only transmitted to the particular measuring instrument for which it is intended. If the program code contains, for example, an updating only the firmware of only the network analysators NA, the control computer 2 transmits this program code to the network analysator 5, the control computer 3 to the network analysator 7 and the control computer 4 to the network analysators 8 and 10. If the program code concerns an updating of the firmware of the spectrum analyzer SpA, the control computer 2 transmits this program code to the spectrum analyzer 6 and the control computer 4 to the spectrum analyzer 9. The control computer 3, which is not coupled to a spectrum analyzer SpA, does not further transmit the program code.

[0013] The program code can, for example, include an addressing in a header from which it can be derived for what type of measuring instrument (in the disclosed embodiment a network analysator NA or spectrum analyzer SpA) that this program code is intended. The control

computer 2, 3 or 4 then transmits the program code only to the particularly addressed measuring instruments.

[0014] Further, a list can be placed in a memory 24 of the central computer 1 that lists for each control computer 2, 3 or 4 the particular type of measuring apparatus (in the disclosed embodiment a network analysator NA or a spectrum analyzer SpA) that are coupled with the respective control computer 2, 3 or 4. The central computer 1 transmits then the program codes only to the control computer 2 or 3 or, if it is coupled to a measuring instrument corresponding to the program code. For example, the central computer 1 in the shown embodiment transmits a program code, which is particularly for the spectrum analyzer only to the control computers 2 and 4. To update this list, the control computers 2, 3 and 4 can provide information to the central computer 1 via the second bus 19 from which it can be determined the type of measuring instruments (in the disclosed embodiment network analysators NA or spectrum analyzers SpA) are coupled to these respective control computers. This information can be transmitted when the measuring system 21 or 22 or 23 is first placed in operation, and can be renewable transmitted when additional measuring instruments are coupled to or removed from the respective control computers 2, 3 or 4.

[0015] In another variant of the method of this invention the program code of the firmware to be updated is not fed to the central computer 1 via a storage medium 18, rather it is fed thereto via the Internet 25. This saves the measuring-device manufacturer from shipping the storage medium 18 to the customer. When updating firmware of a measuring instrument sold by a measuring manufacturer, the measuring-device manufacturer sends to the respective customers that obtained such a measuring instrument of this type from him over the Internet 25 the appropriate program code to update the respective measuring instrument 5-10. This program code is further relayed via the second bus 19 to the

control computers 2, 3 or 4 and via the first bus 20 to the measuring instruments 5, 7, 8, 10 or 6, 9 targeted, or addressed, by the program code as described above.